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HORNER AND SHIFRIN INC ST LOUIS MO
NATIONAL DAM SAFETY PROGRAM, W. G. FIENUP LAKE DAM (NO 10488), --ETC(U)
SEP 78 A B BECKER
DACW43-78-C-0143

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151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195
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1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335
1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350
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1396	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410
1411	1412	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425

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7. AUTHOR(s) Horner & Shifrin, Inc.	8. CONTRACT OR GRANT NUMBER(s) (15) DACW43-78-C-0143	9. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS (12) 59
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18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety, Lake, Dam Inspection, Private Dams		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.		

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: W. G. Feinup Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the
W. G. Feinup Lake Dam.

It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY:

SIGNED

Chief, Engineering Division

18 SEP 1978

Date

APPROVED BY:

SIGNED

Colonel, CE, District Engineer

19 SEP 1978

Date

W. G. FIENUP LAKE DAM
ST. LOUIS COUNTY, MISSOURI
MISSOURI INVENTORY NO. 10488

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY:
HORNER & SHIFRIN, INC.
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FOR:
U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS

SEPTEMBER 1978

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: W. G. Fienup Lake Dam
State Located: Missouri
County Located: St. Louis
Stream: Tributary Bonhomme Creek
Date of Inspection: 8 June 1978

The Fienup Lake Dam was visually inspected by engineering personnel of the office of Horner & Shifrin, Inc., Consulting Engineers, St. Louis, Missouri. The purpose of the inspection was to assess the general condition of the dam with respect to safety and, based upon this inspection and available data, determine if the dam poses a hazard to human life or property.

Based on a visual inspection, the present general condition of the dam is considered to be satisfactory. The following deficiencies were noticed during the inspection and are considered to have an adverse effect on the overall safety and future operation of the dam:

1. Several small trees exist on the upstream slope near the west abutment of the dam. The tree roots may, in time, provide a pathway for lake seepage that could develop into a piping condition.
2. At the time of the inspection, the grass on the downstream slope was on the order of 30-inches high. Grass should not be allowed to grow to a height that provides cover for burrowing animals or hinders inspection of the dam.
3. The pump used to provide lake make-up water was reported to be without a means of preventing pump flow on a continuous basis. Without a spillway or other means to ensure lake surface elevation, there exists the possibility of overtopping the dam due to continued pumping.

The fact that the impoundment has no spillway for relief of lake surcharge is considered a serious safety defect. Without means of relieving surcharge, there exists the potential for overtopping the dam. According to the criteria set forth in the recommended guidelines (see text) the spillway design flood for this dam, which is classified as intermediate in size and of high hazard potential, is specified to be the Probable Maximum Flood (PMF). The PMF is the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. Results of a hydrologic/hydraulic analysis indicated the dam will be overtopped by a storm of PMF magnitude; however, with the lake at normal pool level (elevation 528.0), there is sufficient storage available to contain the runoff resulting from the 1 percent chance (100-year frequency) flood. The length of the downstream damage zone, should failure of the dam occur, is estimated to be 3 miles.

A review of available data did not disclose that seepage and stability analyses of the dam were performed. This is considered a deficiency and should be rectified.

It is recommended that the owner take the necessary action, without delay, to correct the deficiencies and safety defects reported herein.

Albert B. Becker, Jr.
Albert B. Becker, Jr.
P.E. Missouri E-9168



OVERVIEW OF LAKE AND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
W. G. FEINUP LAKE DAM - ID NO. 10488

TABLE OF CONTENTS

<u>Paragraph No.</u>	<u>Title</u>	<u>Page No.</u>
SECTION 1 - PROJECT INFORMATION		
1.1	General	1
1.2	Description of Project	1
1.3	Pertinent Data	4
SECTION 2 - ENGINEERING DATA		
2.1	Design	6
2.2	Construction	7
2.3	Operation	7
2.4	Evaluation	7
SECTION 3 - VISUAL INSPECTION		
3.1	Findings	8
3.2	Evaluation	9
SECTION 4 - OPERATIONAL PROCEDURES		
4.1	Procedures	10
4.2	Maintenance of Dam	10
4.3	Maintenance of Outlet Operating Facilities	10
4.4	Description of Any Warning Systems in Effect	10
4.5	Evaluation	11
SECTION 5 - HYDRAULIC/HYDROLOGIC		
5.1	Evaluation of Features	12
SECTION 6 - STRUCTURAL STABILITY		
6.1	Evaluation of Structural Stability	14

TABLE OF CONTENTS - Continued

<u>Paragraph No.</u>	<u>Title</u>	<u>Page No.</u>
	SECTION 7 - ASSESSMENT/REMEDIAL MEASURES	
7.1	Dam Assessment	15
7.2	Remedial Measures	16

LIST OF PLATES

<u>Plate No.</u>	<u>Title</u>
1	Regional Vicinity Map
2	Site Plan
3	Plan of Dam Area
4	Boring Logs (Profile)
5	Boring Logs (Test Hole 1)
6	Boring Logs (Test Hole 2)
7	Boring Logs (Test Hole 3)
8	Boring Logs (Test Hole 4)
9	Compaction Curve
10	Atterberg Limits
11	Atterberg Limits
12	Dam and Saddle Profiles
13	Discharge Rating Curve
14	PMF Inflow and Outflow Hydrographs

APPENDIX

<u>Page No.</u>	<u>Title</u>
A-1, A-2	Inspection Photographs
B-1 thru B-5	Hydrologic Computations

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
W. G. FIENUP LAKE DAM - ID NO. 10488

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

- a. Authority. National Dam Inspection Act, Public Law 92-367, dated 8 August 1972.
- b. Purpose of Inspection. The purpose of this visual inspection was to make an assessment of the general condition of the dam with respect to safety and, based upon available data and this inspection, determine if the dam poses a hazard to human life or property.
- c. Evaluation Criteria. This evaluation was performed in accordance with the "Phase I" investigation procedures as prescribed in "Recommended Guidelines for Safety Inspection of Dams," Appendix D to "Report of the Chief of Engineers on the National Program of Dams" dated May 1975.

1.2 DESCRIPTION OF PROJECT

- a. Description of Dam and Appurtenances. The Fienup Lake Dam is an earthfill type embankment rising approximately 71 feet above the original stream bed. There is no spillway to govern the level of the lake, nor is there an outlet pipe to dewater the lake. A natural topographic saddle, with the low point approximately 0.2 foot lower than the minimum elevation of the dam crest, exists near the upstream end of the lake at the east side. At normal pool, the lake occupies approximately 28 acres. Normal pool was assumed to be elevation 528.0 since, according to the owner, this level is the desired lake surface elevation. A pump is used to provide lake make-up water

from nearby Caulks Creek when the lake surface lowers to an undesirable level. The lake and dam are privately owned. A plan of the lake and dam area is shown on Plate 2.

b. Location. The dam and lake are located on an unnamed tributary of Bonhomme Creek, approximately 2 miles west of Chesterfield, Missouri, in St. Louis County, as shown on the Regional Vicinity Map, Plate 1. The dam is located in U.S. Survey 125, Township 45 North, Range 4 East, immediately upstream of the Chicago-Rock Island and Pacific Railroad Company's main line track.

c. Size Classification. The classification for size based on the height of the dam and storage capacity is categorized as intermediate. (Per Table 1, Recommended Guidelines for Safety Inspection of Dams.)

d. Hazard Classification. The Fienup Lake Dam, according to the St. Louis District, Corps of Engineers, has a high hazard potential, meaning that the dam is located where failure may cause loss of life, serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads. The estimated flood damage zone, should failure of the dam occur, as determined by the St. Louis District, extends three miles downstream of the dam. Within the possible damage zone are the town of Gumbo, a levee, a railroad, a highway, and an airport.

e. Ownership. The lake and dam are owned by Mr. Wilbur G. Fienup, Rural Route 1 (Wild Horse Creek Road), P.O. Box 670, Chesterfield, Missouri, 63017.

f. Purpose of Dam. The dam impounds water for the purpose of private recreation and for aesthetic reasons.

g. Design and Construction History. In about 1969, an investigation of the proposed lake and dam site was made at the request of the owner by the Soil Conservation Service (SCS), St. Louis County, U.S. Department of Agriculture. Findings of the SCS indicated that the site overburden consisted

primarily of soils with a high content of fine sand, and therefore, without special treatment to reduce the permeability, was not considered to be a favorable location to construct a lake. The owner, however, elected to proceed and construction of the dam and lake was undertaken in the summer of 1970 and completed in the fall of that same year. The firm of Brucker & Thacker, Consulting Engineers, Brentwood, Missouri, was retained by the owner to perform certain laboratory and field tests during construction of the dam. The Mueller Surveying and Engineering Co., St. Louis County, Missouri, was also retained to locate the structure and to provide survey control during construction. Research did not reveal that detailed design analyses of the lake (hydrologic) or dam (stability and seepage) were performed.

The owner reported that an earthfill seepage cutoff trench, approximately 14 feet wide at the base, was constructed along the centerline of the dam, and that fill material was placed along the entire course of the original stream and tributaries to the top of bank elevation within the proposed limits of the lake in an effort to reduce anticipated seepage through the lake bottom. The fill material in the stream channel was reported to be a minimum of 10 feet in depth at the dam. The earth work for construction of the dam was placed by the Norvel Construction Co. of Florissant, Mo.

After completion of the dam, the lake was partially filled and bentonite was distributed over the lake bottom in order to further reduce seepage. The owner reports that the lake presently loses water due to seepage and evaporation at a rate of about 0.7 inches per day. Water is pumped to the lake from nearby Caulks Creek in order to make up the lost water. When the lake level drops to an elevation considered too low by the owner, the pump is operated continuously until such time when the lake surface reaches the desired level. The lake level is presently maintained about 1.5 feet below elevation 528.0, the desired lake level.

h. Normal Operational Procedure. The lake level is unregulated. In addition to inflow from precipitation runoff, the lake level is dependent upon pumping and the availability of water in Caulks Creek.

1.3 PERTINENT DATA

a. Drainage Areas. The areas tributary to the lake are primarily agricultural in use and include several residences. The watershed above the dam amounts to approximately 85 acres. The watershed area is outlined on Plate 1.

b. Discharge at Damsite.

- (1) Estimated known maximum flood at damsite ... Unknown
- (2) Spillway capacity ... No spillway provided

c. Elevation (ft. above MSL). The crest of the dam, at a point near the center of the dam, was assumed to be elevation 532.8, the basis of this assumption being the elevation shown for the dam crest on the site plan drawing (see Plate 2) furnished by the owner. The following elevations were measured in the field using the above elevation as a benchmark.

- (1) Top of dam ... 532.7 (min.)
- (2) Saddle ... 532.5 (min.)
- (3) Normal pool (per Owner) ... 528.0
- (4) Streambed at centerline of dam ... 469.0⁺
- (5) Maximum tailwater ... Unknown

d. Reservoir.

- (1) Length of pool (elevation 532.7) ... 2,450 ft.
- (2) Length of normal pool (elevation 528.0) ... 2,400 ft.

e. Storage.

- (1) Normal pool ... 359 ac.ft.
- (2) Saddle (incremental) ... 143 ac.ft.
- (3) Top of dam (incremental) ... 7 ac.ft.

f. Reservoir Surface.

- (1) Top of dam ... 36 acres
- (2) Normal pool ... 28 acres

g. Dam.

- (1) Type ... Earthfill, homogeneous
- (2) Length ... 360 ft.
- (3) Height ... 71 ft.
- (4) Top Width ... 12 ft.
- (5) Side Slopes
 - (a) Upstream ... 1v on 3h
 - (b) Downstream ... 1v on 3h
- (6) Zoning ... None
- (7) Impervious Core ... None
- (8) Cutoff ... Earthfill Trench (per Owner)
- (9) Slope Protection
 - (a) Upstream ... Rock riprap, dumped
 - (b) Downstream ... Grass

h. Spillway ... None provided

i. Outlet for Lake Drawdown ... None provided

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Test borings along the alignment of the dam, as presented in the Brucker & Thacker report, are shown on Plates 4 through 8. The locations of these borings are shown on Plate 3. Plate 3 also shows the topography of the dam area prior to construction, the proposed location of the dam, and the dam profile (section). According to the Mueller Surveying and Engineering Co., who prepared the drawing (Plate 3), the topography was developed from survey data while the dam location and profile, as shown on this drawing, were described as directed by the owner.

Analyses performed by Brucker & Thacker included compaction tests, grain size determination, hydrometer analyses, sieve analyses, Atterberg Limits, permeability, and water infiltration tests. This test data was reviewed and believed to be adequate for the purpose intended.

As indicated on the compaction test data sheets in the Brucker & Thacker report, material to be used for construction of embankment consisted of brown, very slightly clayey, silt. The compaction test (see Plate 9) used to monitor compaction of the fill indicated a maximum dry density of 113.9 pcf at 15.1 percent optimum moisture content, per ASTM D-1557. A liquid limit of 40 and a plastic limit of 16 were also indicated for the material used in the compaction test. Results of Atterberg Limits of material from borrow areas used in construction of the embankment are shown on Plates 10 and 11.

Research did not reveal that detailed hydrologic analysis or analyses to determine the stability of the dam or seepage through the dam were performed by Brucker & Thacker or others.

2.2 CONSTRUCTION

Records maintained during construction of the dam consisted of the results of field density tests. As indicated in the Brucker & Thacker report, for a total of 63 tests taken during July and August of 1970, the average of these field tests was found to be 88.8 percent of maximum dry density, per ASTM D-1557.

2.3 OPERATION

The owner reports that the maximum level experienced to date is approximately elevation 527.0. The level of the lake on the date of the inspection was determined to be approximately elevation 526.5, or about 1.5 feet below the desired normal level. There is no spillway to govern the level of the lake.

2.4 EVALUATION

a. Availability. Engineering data for assessment of the hydrologic features of the watershed lake area was unavailable. Data for determining the strength of the earthfill dam and/or its stability was also unavailable.

b. Adequacy. The engineering data available to make a detailed assessment of the design of the dam is inadequate. The soil tests performed by and reported in the Brucker & Thacker report, with the exception of compaction tests for evaluating the field density tests, are considered to be for the purpose of determining the suitability of the site and materials to be used in construction of the dam.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the dam and lake shoreline was made by Horner & Shifrin engineering personnel on 8 June 1978. Also inspected at this time was the area downstream from the dam that includes a culvert beneath the Chicago-Rock Island and Pacific Co. Railroad tracks and the bridges crossing Bonhomme Creek at Chesterfield Airport Road and U.S. Highway 40-61. Photographs of the dam taken during the inspection are included on pages A-1 and A-2 of the Appendix.

b. Dam. The upstream and downstream slopes of the dam were found to be in good condition. The upstream slope of the dam was protected with dumped limestone riprap (ranging in size from small pieces weighing less than 5 pounds to large pieces estimated to weigh approximately 200 pounds) to about elevation 530.0. At the time of inspection, it was not determined how far below the lake surface the riprap extended. Several small trees were observed growing in the upstream face near the west abutment. No cracks were noticed in the dam surface, nor were there any holes or animal burrows detected in the face of the dam. A profile of the dam crest centerline, as determined by survey, is shown on Plate 3. The downstream face had a substantial cover of grass to protect the slope. No indication of seepage at the downstream toe of slope was noticed. A flow of about 10 gpm was observed in the culvert, located approximately 380 feet downstream of the dam, beneath the railroad tracks. The origin of this flow could not be determined, however this quantity is not considered significant.

c. Appurtenant Structures. There are no spillways, drawdown pipes, or gate structures appurtenant to the dam.

d. Reservoir Area. The shoreline of the lake was found to be in good condition and well maintained. Inflow from the upstream tributary area enters

the lake through an 18-inch corrugated metal pipe. This pipe serves as a culvert in order to allow an access road to cross the incoming stream. No noticeable evidence of sedimentation was observed.

e. Downstream Channel. The original course (there is no spillway or outlet channel) is unimproved and joins Bonhomme Creek at a point approximately 350 feet below the downstream toe of the dam. A 5'h x 6'w reinforced concrete box culvert carries the stream flow beneath the railroad tracks. The culvert is located about 230 feet from the toe of the dam at this point.

3.2 EVALUATION

With the exception of the lack of a spillway, there were no structural or other deficiencies noted during the visual inspection that require immediate corrective action.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no outlet works for this dam; therefore, no regulating mechanism to govern the lake level exists. The pool level is governed by rainfall runoff, evaporation, and flow pumped from Caulks Creek to make up water lost by seepage and evaporation. When in operation, water is pumped to the lake at a rate of 750 gpm. The pump is electrically operated and has no automatic controls to regulate usage. The pump is operated at intervals in order to maintain the lake level at about elevation 526.5.

4.2 MAINTENANCE OF DAM

The dam is well maintained. The slopes not otherwise protected have a substantial grass cover. According to the owner, the grass on the slopes is mowed periodically throughout the growing season. Several small trees have been permitted to grow on the dam near the west abutment.

4.3 MAINTENANCE OF OUTLET OPERATING FACILITIES

No outlet operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEMS IN EFFECT

The inspection did not reveal the existence of a dam warning system.

4.5 EVALUATION

Based on the substantial cover of grass on the downstream slope and the riprap protection on the upstream slope, as well as the general condition of the dam, it is evident that the dam is well maintained. It is recommended, however, that the trees present in the upstream slope be removed and that the grass on the downstream slope be cut more often.

It is recommended that the pump used to furnish the lake with make-up water be provided with some means to prevent filling the lake beyond the normal pool level.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data is available.

b. Experience Data. The tributary drainage area and lake surface area were developed from USGS Chesterfield, Mo. Quadrangle map. The lake and dam layout, including surface elevations, was obtained from drawings furnished by the owner. Elevations and dimensions considered critical to the operation of the dam were verified by surveys made during the inspection.

c. Visual Observations.

(1) The dam is not provided with a spillway.

(2) Examination of the topography (see Plate 2) indicated the existence of a natural saddle near the upstream end of the lake at the east side. The low point of the saddle, according to the elevations indicated on Plate 2, is approximately 0.2 foot lower than the minimum elevation of the dam crest. This saddle will allow lake outflow, in the event of PMF, at an elevation slightly lower than the crest of the dam.

(3) Drawdown facilities are not available to unwater the lake.

d. Overtopping Potential. Since a spillway is not provided, the operation of the lake for the occurrence of the PMF based on 48-hour rainfall was investigated. It was found, for the 48-hour rainfall, that the dam would be overtopped. The results of the dam overtopping analysis are as follows:

<u>Ratio of PMF</u>	<u>Q - Peak Outflow (cfs)</u>	<u>Max. Lake Water Surface Elev.</u>	<u>Max. Depth of Flow Over Dam (Elev. 532.7)</u>	<u>Duration of Overtopping of Dam (Hours)</u>
0.50	0	532.0	0	0
0.61	10	532.7	0	0
1.0	286	533.35	0.65	8.33
100-Year Flood ⁽¹⁾	0	529.4	0	0

(1) 24-hour duration rainfall.

The flow passing over the saddle upstream of the dam just prior to overtopping amounts to about 10 cfs, which is the outflow corresponding to about 61 percent of the probable maximum flood inflow. The runoff from the 1 percent chance (100-year frequency) flood is completely stored within the lake.

Procedures for determining the probable maximum flood and the discharge rating curve for flow over the dam crest and the saddle are presented on Pages B-1 and B-2 of the Appendix. A listing of the HEC-1DB input data is shown on Pages B-3 through B-5 of the Appendix.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. No evidence of instability of the dam was noticed during the visual inspection of 8 June 1978. Further, no mention of slides or other signs of instability were reported by the owner.

b. Design and Construction Data. No design data other than tests made for the purpose of identifying soil materials and properties, is available. Construction data available is limited to tests made to determine soil density and compactive effort.

c. Operating Records. According to the owner, the dam has not been monitored in any form during the post construction period.

d. Post Construction Changes. Since completion of construction in 1970, the owner reports that there have been no changes to the dam.

e. Seismic Stability. Since the dam is located within a Zone II seismic probability area, an earthquake of the magnitude predicted is not expected to produce a hazardous condition to the dam, provided that static stability conditions are satisfactory and conventional safety margins exist.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. A hydrologic analysis indicated that, in the event of probable maximum flood with the lake surface prior to storm water runoff at elevation 528.0, the lake level will rise and overtop the dam.

Investigations conducted during this inspection did not disclose that stability or seepage analyses of the dam had been performed.

b. Adequacy of Information. Due to the limited nature of the engineering design and construction data available, the conclusions reached in this report were based principally on external conditions as determined during the visual inspection. This information is considered adequate to support the conclusions herein. Those recommendations with regard to the hydrology of the lake are based on a hydrologic study as indicated in Section 5 of this report.

c. Urgency. The safety defects noted in Paragraph 7.1a. should be investigated without delay since failure of the dam could result from overtopping or instability. The remedial measures recommended herein should be accomplished in the near future.

d. Necessity for Phase II. Based on the results of the Phase I inspection, a Phase II inspection is not recommended.

e. Seismic Stability. Since the dam is located in a Zone II seismic design area, an earthquake of the predicted magnitude is not expected to be hazardous to the dam, provided that static stability conditions are satisfactory and conventional safety margins exist.

7.2 REMEDIAL MEASURES

a. Recommendations. The following actions are recommended:

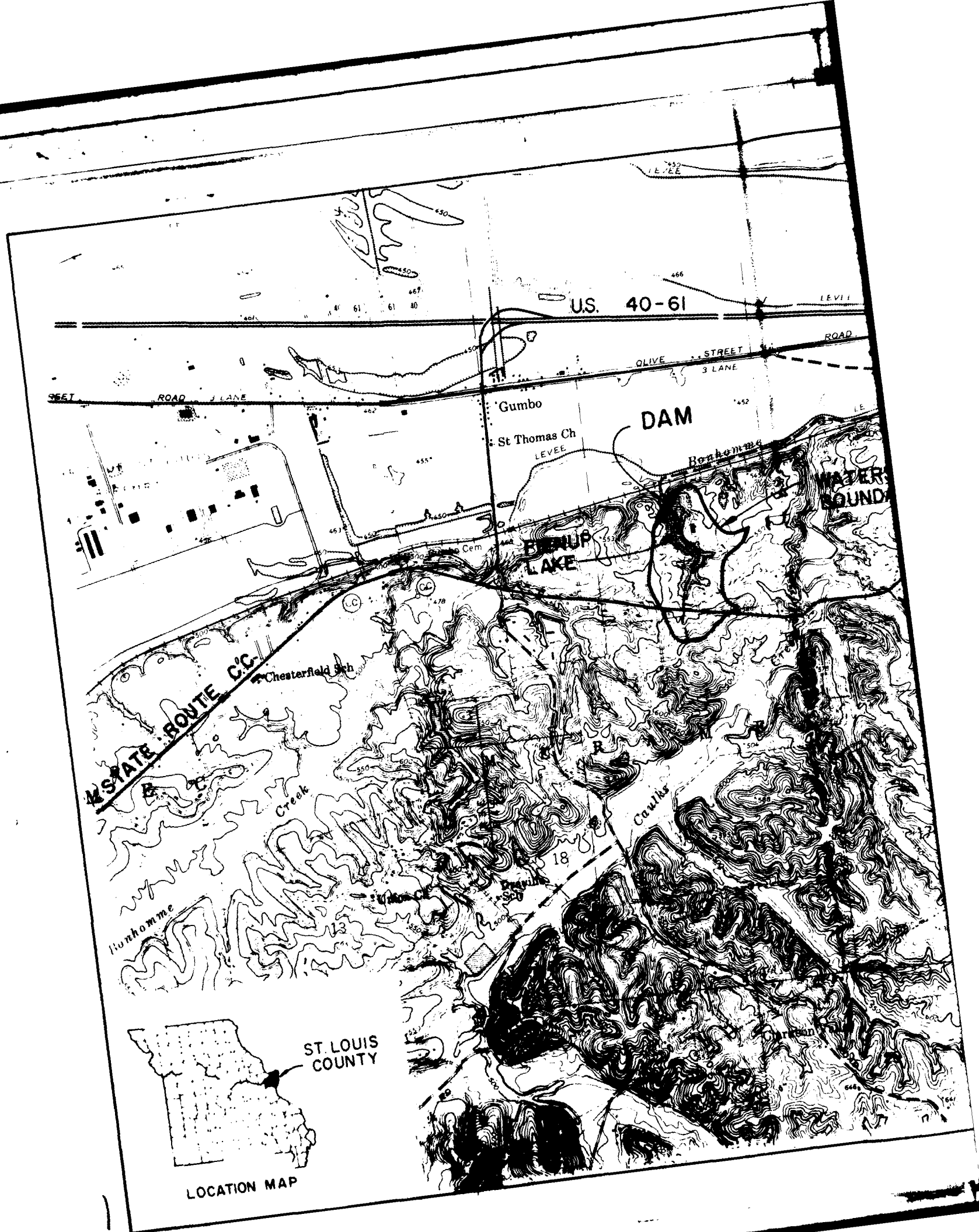
(1) A spillway should be provided in order to pass the lake outflow resulting from storm runoff of PMF without danger of failure if the normal level of the lake is to be elevation 528.0. A spillway will also prevent filling of the lake beyond the normal pool level by pumping.

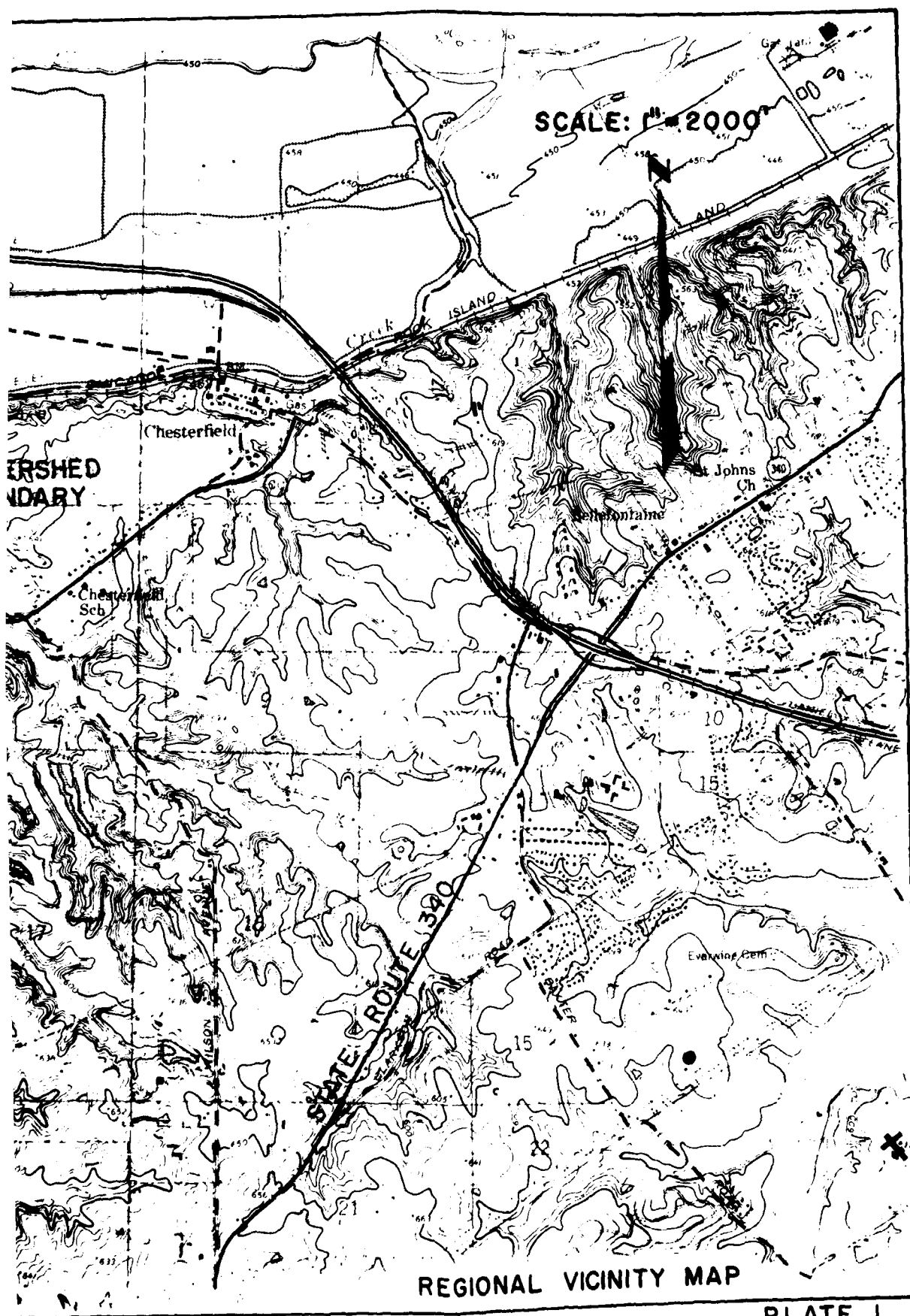
(2) Obtain the necessary soil data and perform stability and seepage analyses to determine the safety of the dam for all operational conditions.

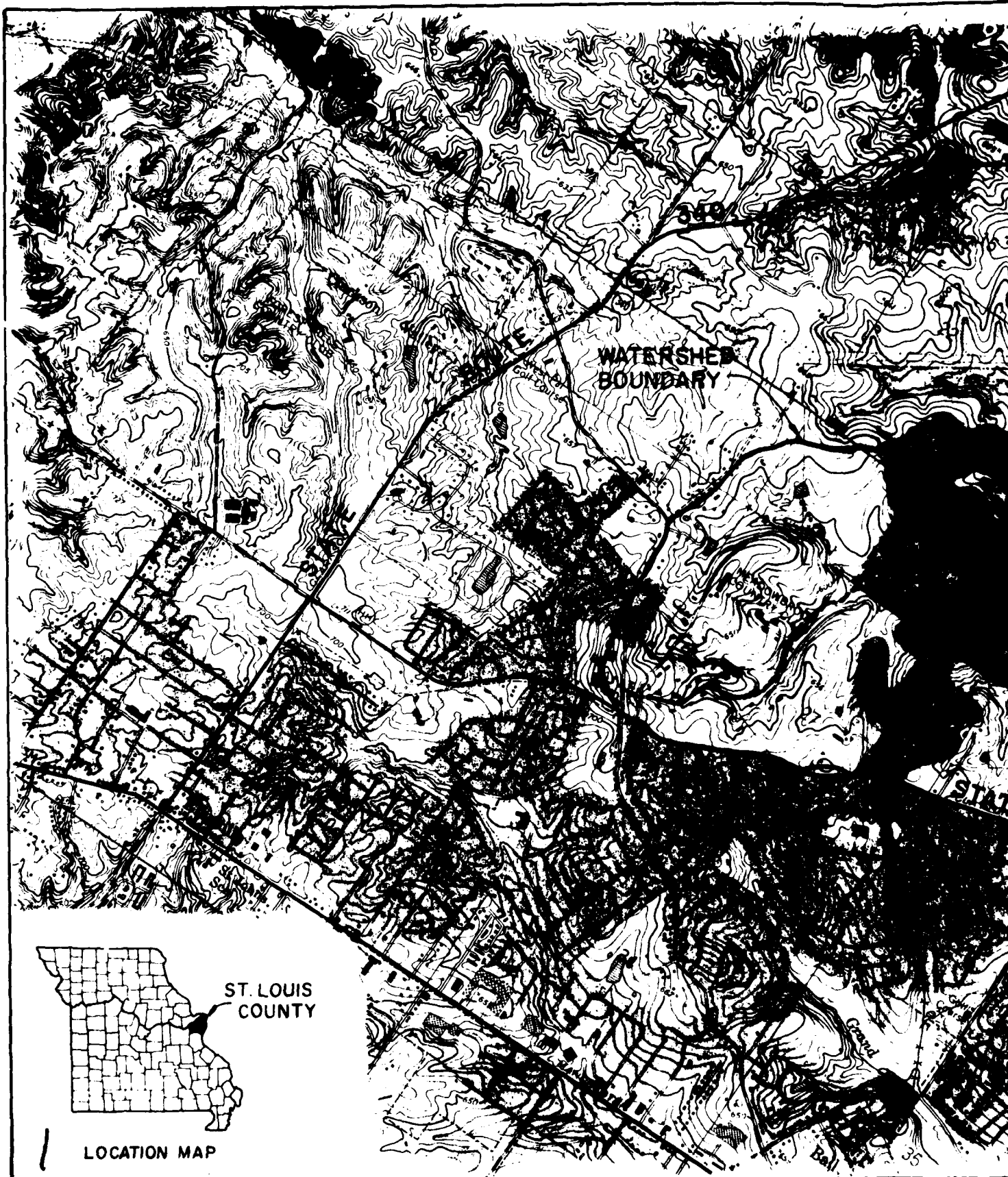
b. O & M Maintenance and Procedures. The following O & M maintenance and procedures are recommended:

(1) Remove the trees from the upstream slope of the dam. Tree roots provide a passageway for seepage that can lead to a piping condition and potential failure.

(2) Cut the grass more frequently on the downstream slope. Grass should not be allowed to grow to a height that hinders inspection of the dam and provides cover for burrowing animals.









REGIONAL VICINITY MAP

2

PIENUP

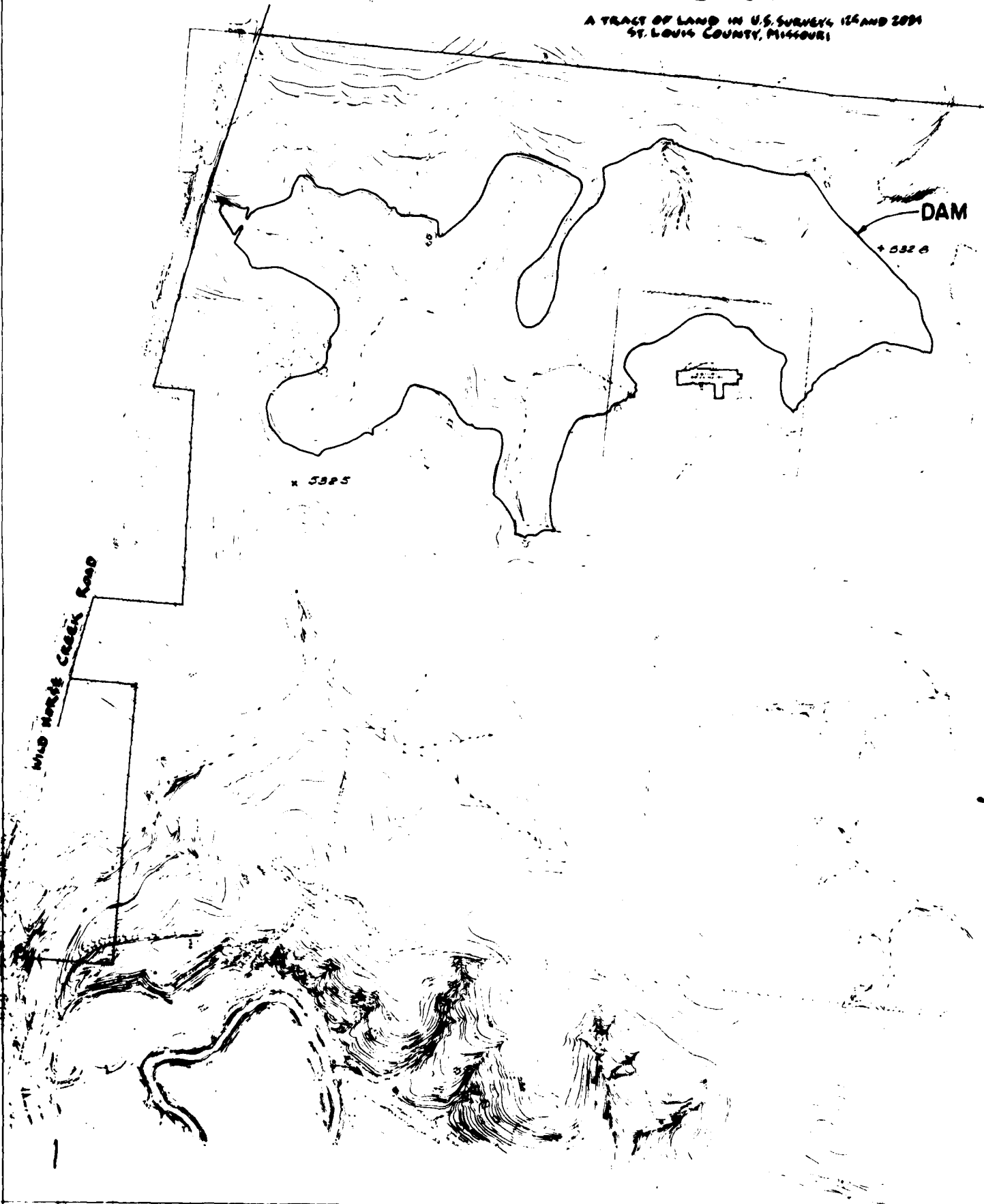
A TRACT OF LAND IN U.S. SURVEYS 124 AND 2091
ST. LOUIS COUNTY, MISSOURI

DAM

+ 532.6

x 538.5

WILD HORSE CREEK ROAD



WRECK 12 AND 204
44081

DAM

CULVERT

+ 032.6

CHICAGO-ROCK ISLAND AND PACIFIC RAILROAD



SCALE IN FEET

2

SITE PLAN

PLATE 2

Keller
Nov. 3-1
58 20m 6

A TRACT OF LAND IN
U. S. SURVEY 125, TP. 45N. R. 4 E.
ST. LOUIS COUNTY, MISSOURI

CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD

105 30

S. 80° - 27' W

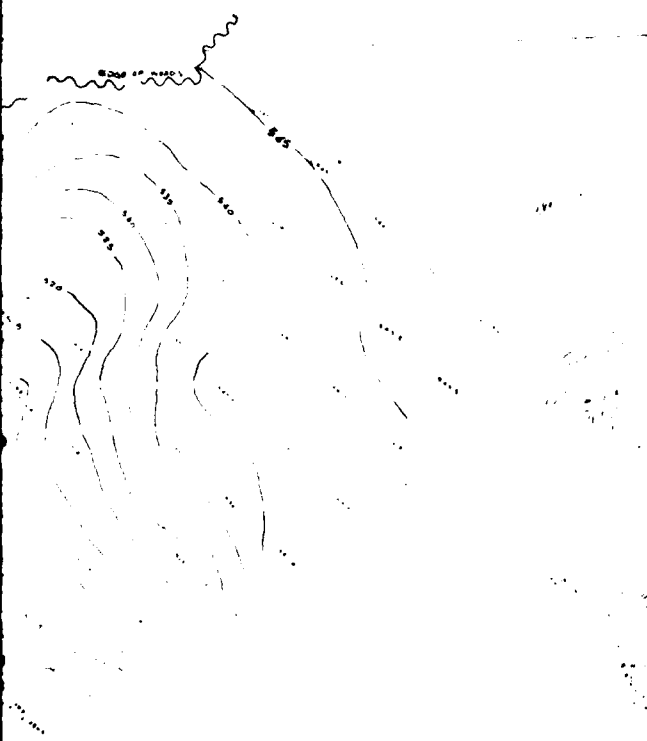
DAM PROFILE

433 FLOODGATE

620 WATER LEVEL

SEA

AD



N



SCALE IN FEET

DAM PROFILE

433 FACEBOARD

428 WATER LEVEL

SCALE HOR. 1"=60'
VERT. 1"=10'

PLAN OF DAM AREA

PLATE 3

2



32

31

30

29

TH 3

SCALE 1" = 30'
M

TH 1

TH 2

TH 1

525

500

475

Light grey to white
cherty limestone.

TH 2

500

475

Light grey to white
cherty limestone.

TH 3

450

Light
limest

29

28

27

26

25

TH 3

TH 4

M

TH 3

450

Light grey to white cherty
limestone.

TH 4

Ground eleva-
tion along grid
line "M."

525

500

475

450

425

Light grey to white
cherty limestone.

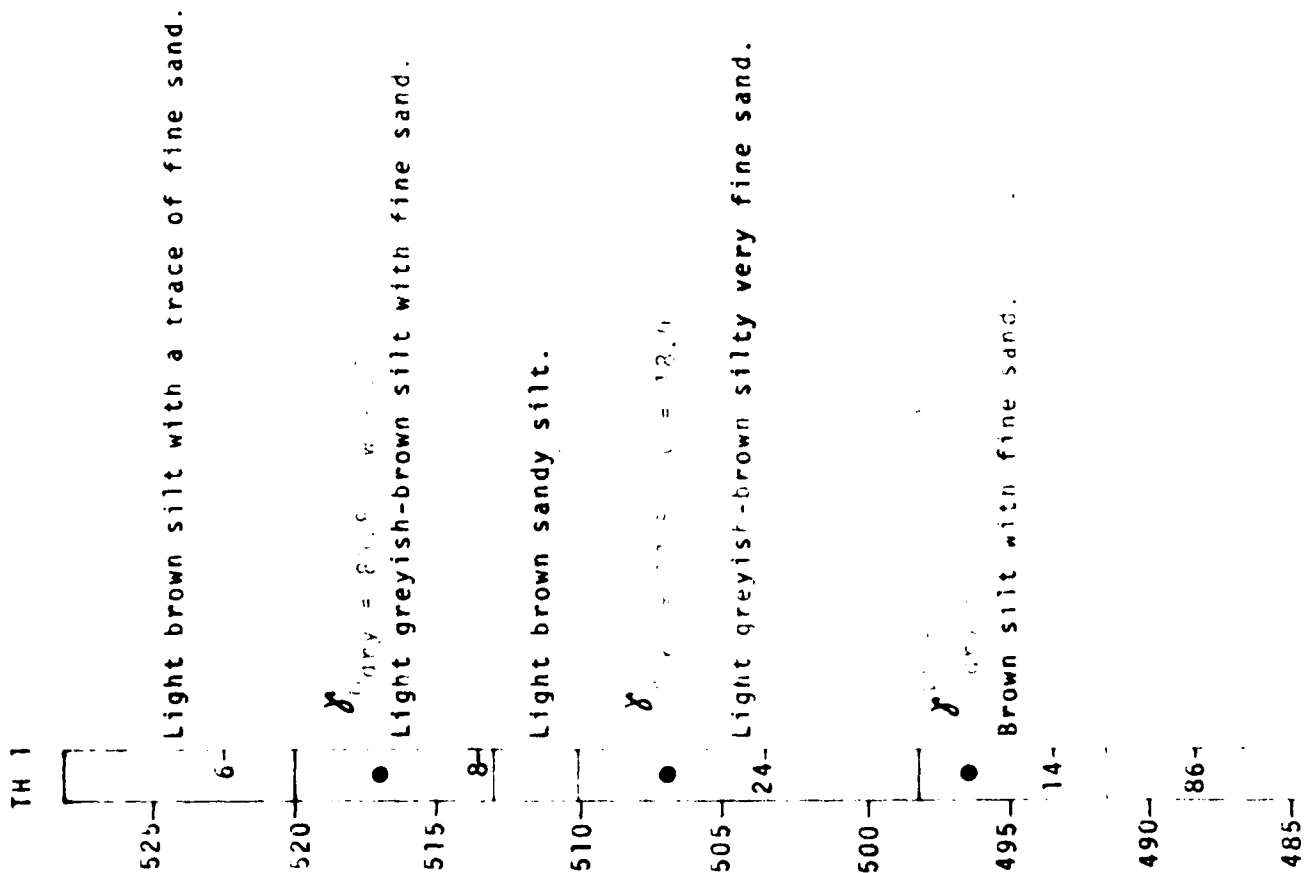
Looking Upstream

Fienup's Dam
Chesterfield, Missouri

BORING LOGS

Brucker & Thacker
Consulting EngineersBrentwood, Mo.
July 1970

Plate 4



14-

490-

86-

485-

480-

475-

470-

465-

460-

455-

Reddish-brown and brown clay with chert
and limestone fragments.

Light grey to white cherty limestone.

No ground-water encountered.

C=60"
R=11"

C=60"
R=13"

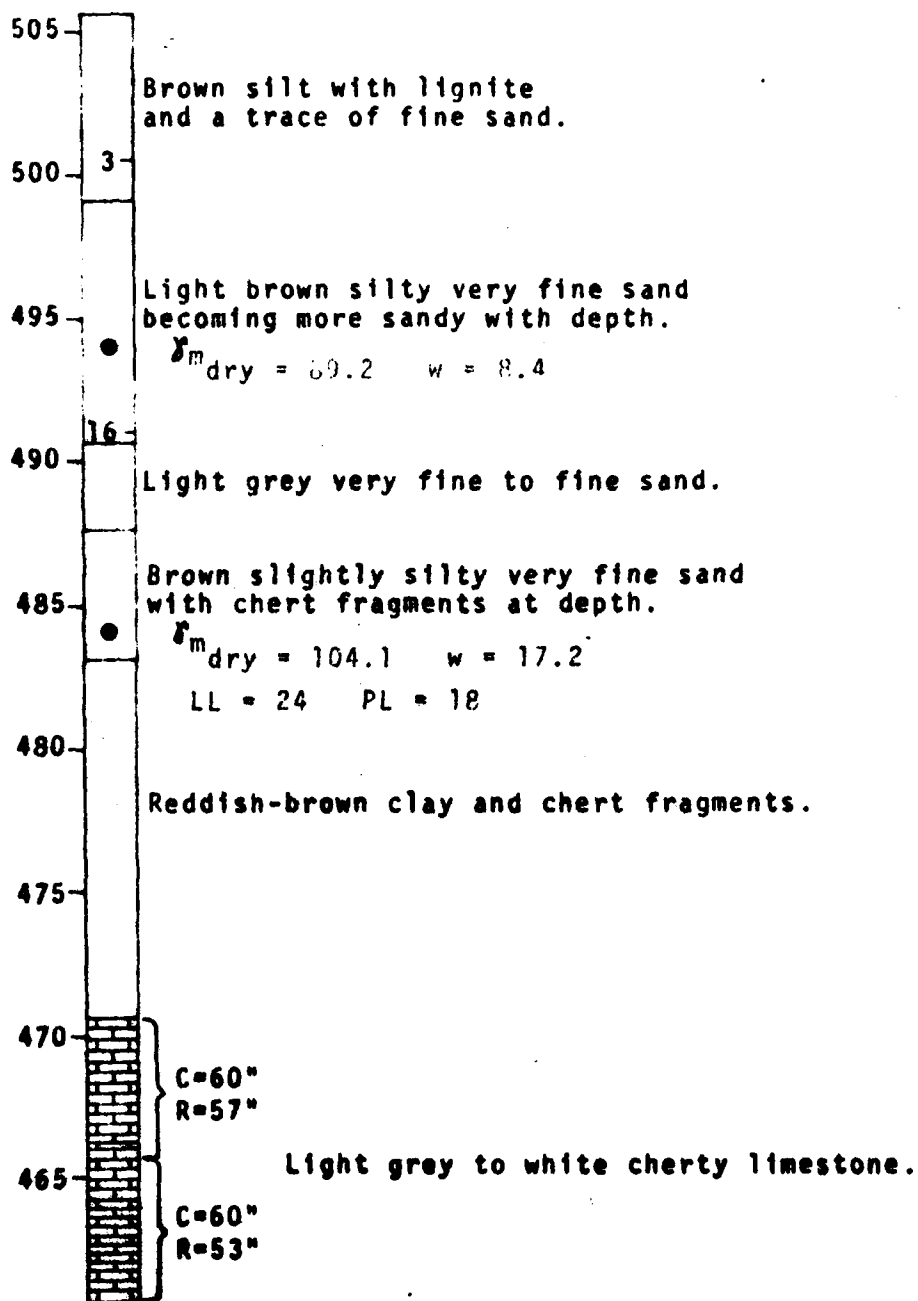
C=24"
R=24"

2

Fienup's Dam
Chesterfield, Missouri
BORING LOGS
Brucker & Thacker
Consulting Engineers
Brentwood, Mo.
July 1970

Plate 5

TH 2



No ground-water encountered.

Fienup's Dam
Chesterfield, Missouri
BORING LOGS

Brucker & Thacker
Consulting Engineers

Brentwood, Mo.
July 1970

TH 3

brown silt with lignite and fine sand.

465

3

4 - Brown and light grey clayey silt
with limestone and chert fragments at depth.

460

C=60"
R=46"

455

C=60"
R=56"

Light grey to white cherty limestone.

450

C=54"
R=43"

No ground-water encountered.

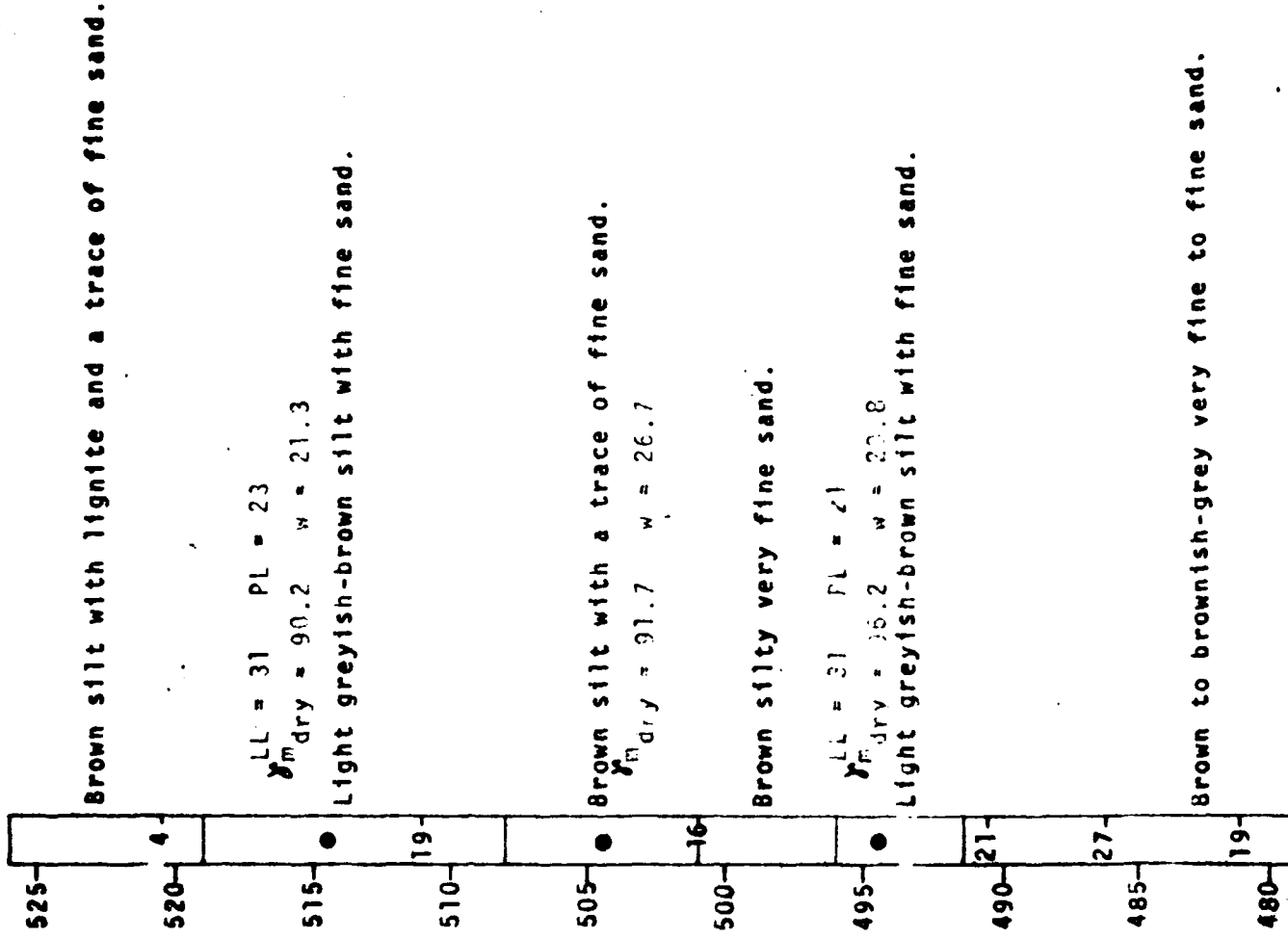
Fienup's Dam
Chesterfield, Missouri

BORING LOGS

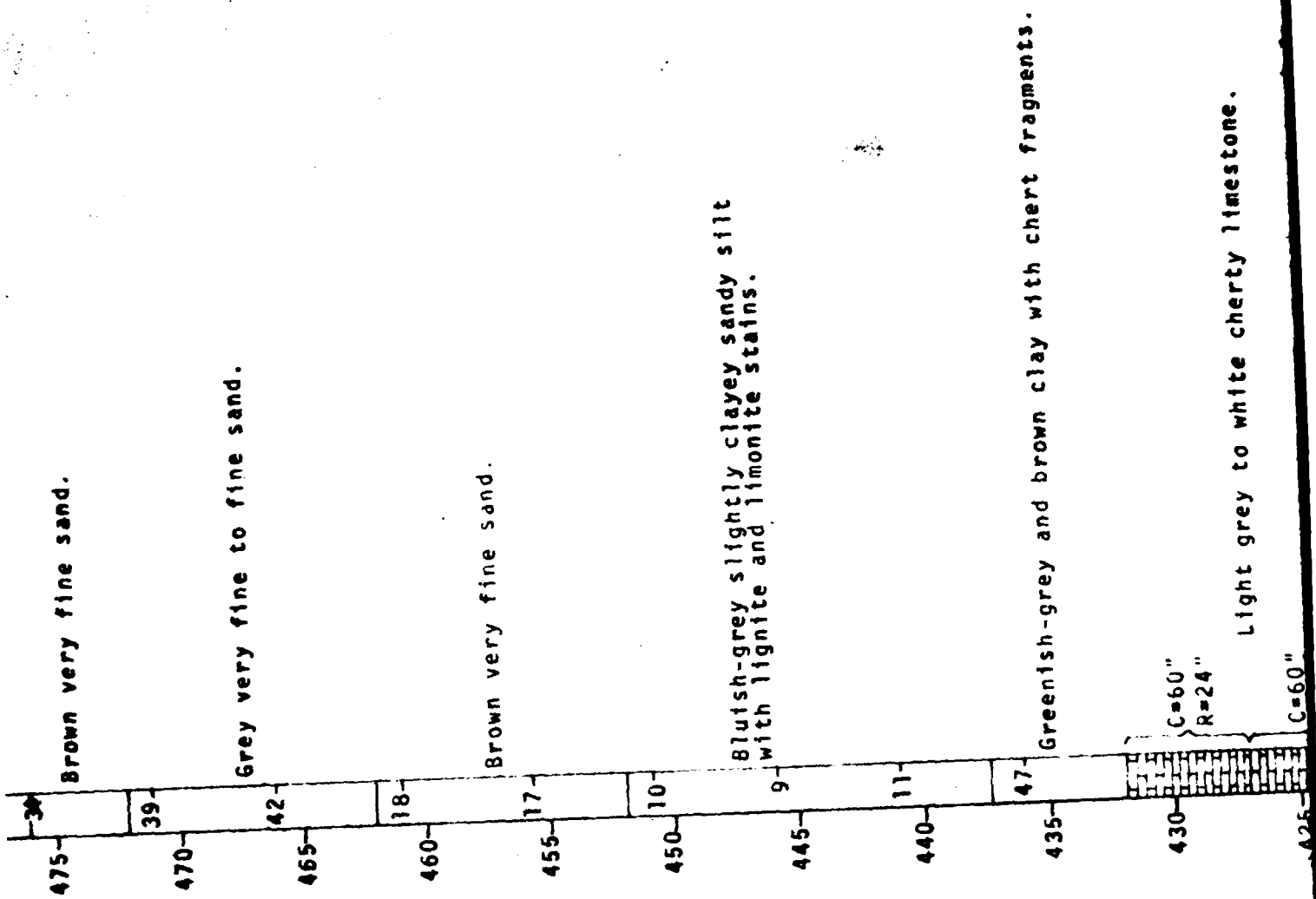
Brucker & Thacker
Consulting Engineers

Brentwood, Mo.
July 1970

TN 4



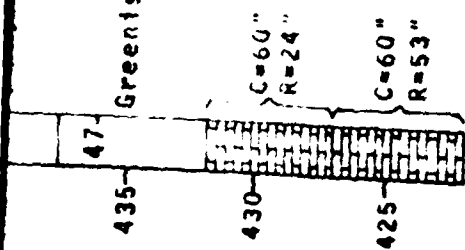
2



Greenish-grey and brown clay with chert fragments.

Light grey to white cherty limestone.

No ground-water encountered.



Flonup's Dam
Chesterfield, Missouri
BORING LOGS

Brucker & Thacker
Consulting Engineers

Brentwood, Mo.
July 1970

Plate 8

ASTM D. 1557-70

115

Laboratory
Oven

110

Dry unit weight (pcf)

R 37

Depth = 2'

Brown very slightly
clayey silt.

LL = 40

PL = 16

Field
Oven

105

Fleming's Dam
Chesterfield, Missouri
COMPACTION CURVE

Brucker & Thacker
Consulting Engineers

Brentwood, Mo.
July 1970

10

12

14

16

18

20

Moisture content (%)

PLATE 9

FIENUP'S DAM
CHESTERFIELD, MISSOURI

July 1970

Atterberg Limits

<u>Test Hole</u>	<u>Depth</u>	<u>Liquid Limit</u>	<u>Plastic Limit</u>
1	2'	30	23
	13'	30	21
2	5'-6'	37	22
	15'-16'	Non-Plastic	
3	5'-6'	39	20
4	5'-6'	51	21
	15'-16'	23	25
11	2'	43	17
	5'	39	20
	15'	33	26
12	2'	42	18
	5'	45	18
13	2'	44	17
	5'	45	19
14	2'	46	18
	5'	45	20
	15'	33	23
15	2'	38	18
	5'	44	18

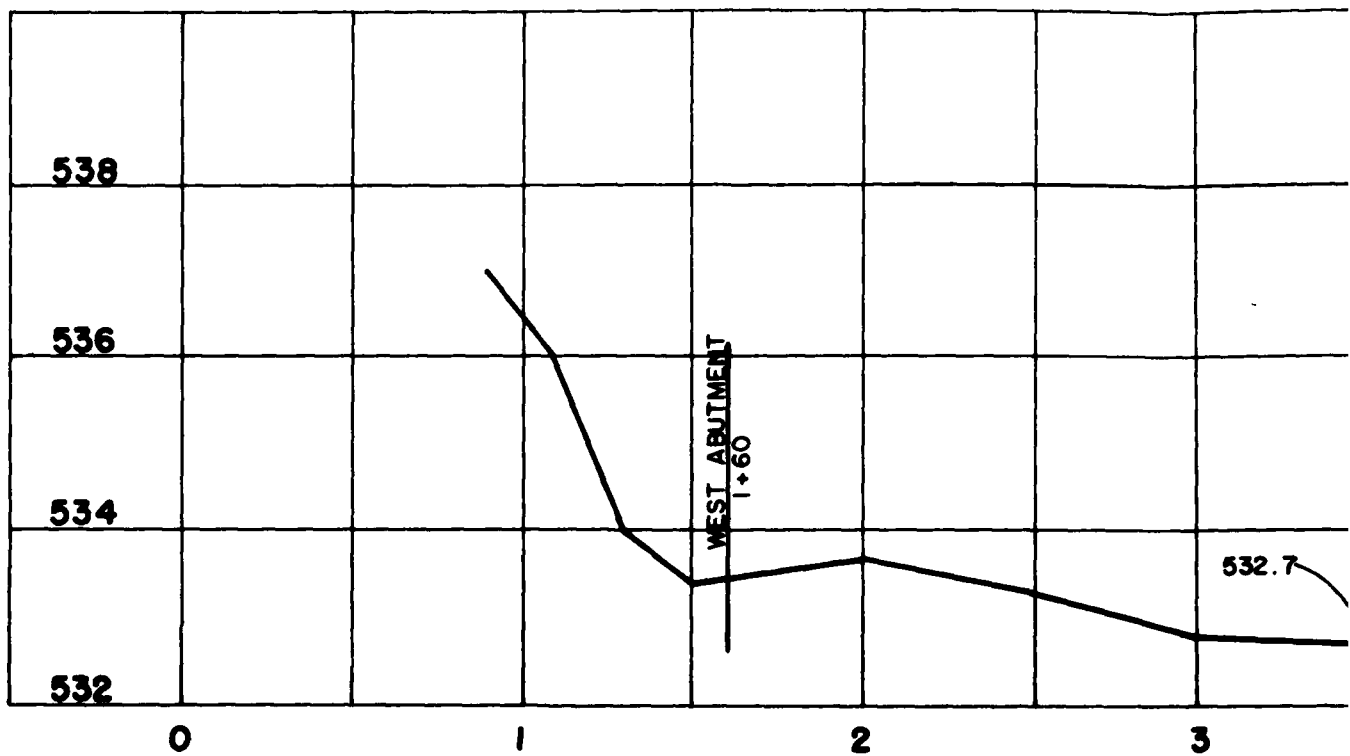
For locations of Test Hole's 1 through 4, see Figure 1.

Test Hole locations 11 through 15 chosen by W.G. Fienup in proposed borrow area. Location not surveyed by this office.

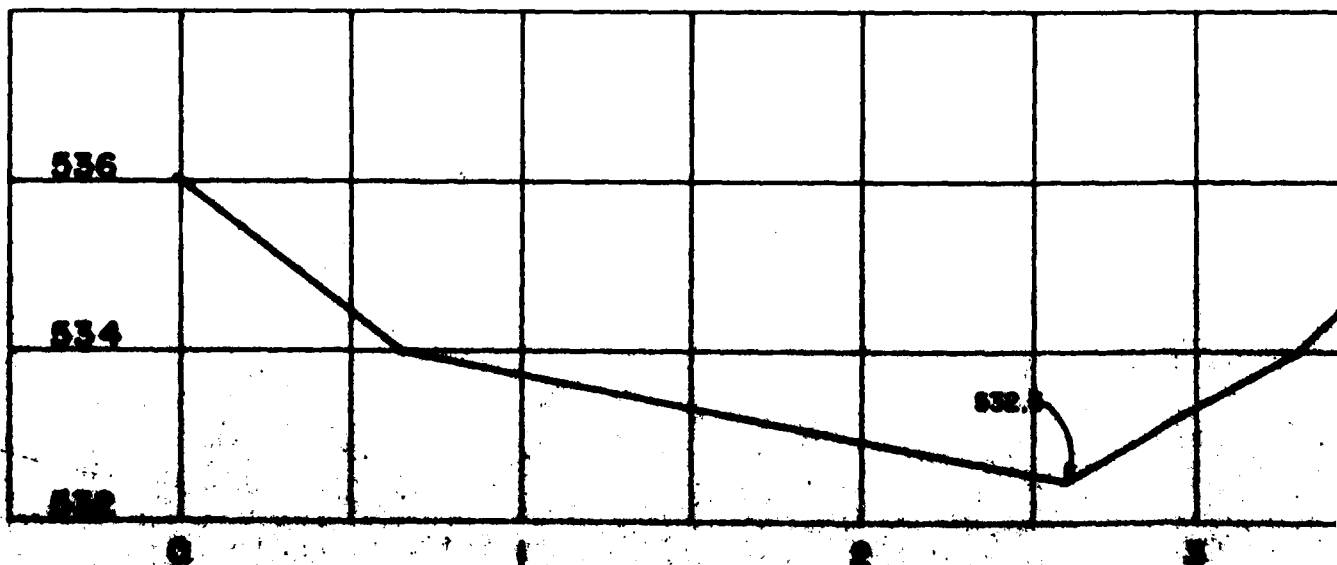
ATTERBERG LIMITS

FIENUP'S DAM

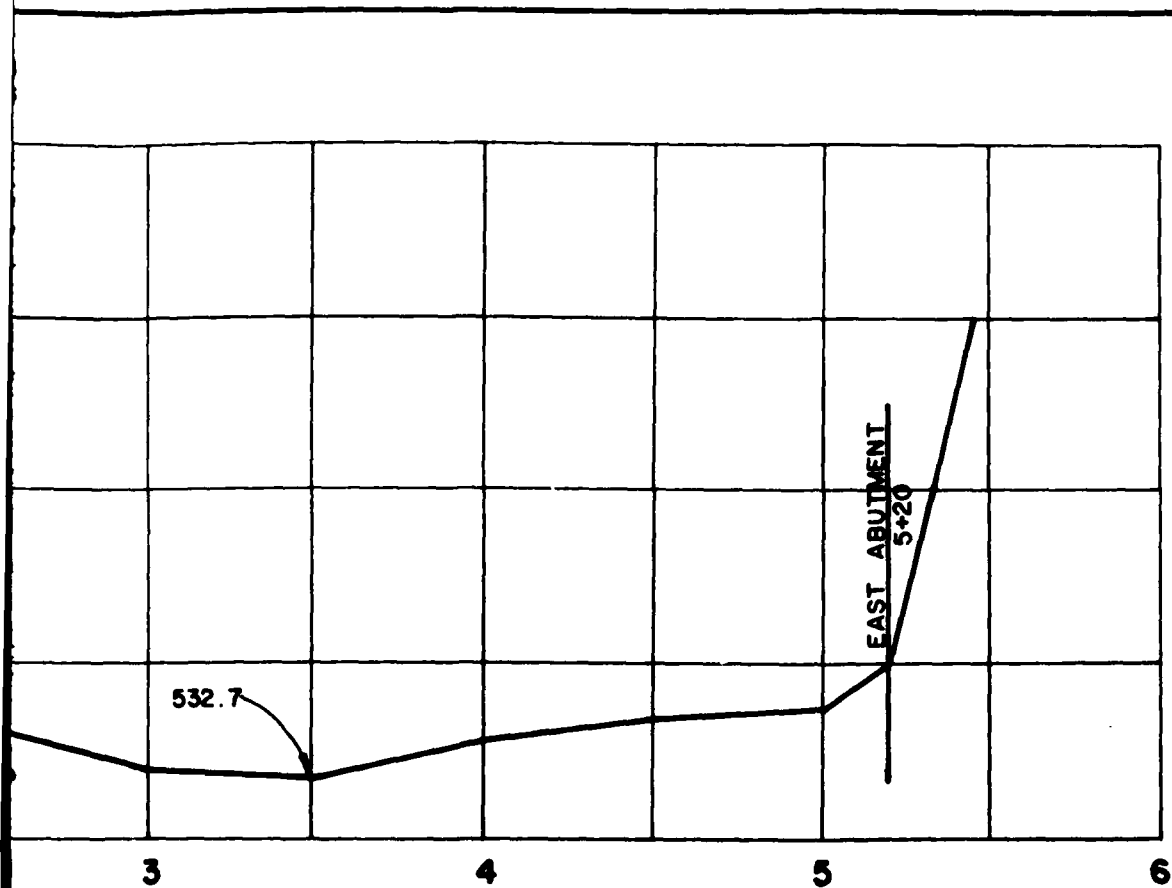
<u>Location</u>	<u>Liquid Limit</u>	<u>Plastic Limit</u>
BB-15 @ 1'	52	20
BB-15 @ 12'	35	20
EE-16 @ 1'	36	19
EE-16 @ 1½'	51	20
EE-16 @ 5'	48	19
EE-16 @ 10'	40	19
FF-10 @ 6'	48	23
J-23 @ 1'	45	18
J-23 @ 3'	48	20
M-19 @ 1'	44	20
M-19 @ 3'	47	21
M-19 @ 5'	42	18
MM-18 @ 1'	26	20
NN-16 @ 6'	33	20
O-17 @ 1'	48	20
Q-20 @ 1'	25	21
Q-20 @ 3'	40	18
Q-20 @ 10'	39	20
S-20 @ 1'	28	22
S-20 @ 1½'	42	18
S-20 @ 8'	38	19
S-39 @ 1'	48	22
S-39 @ 3'	45	23
X-31 @ 2'	51	18
X-31 @ 4'	41	23
X-31 @ 7'	33	20
X-31 @ 10'	32	23
X-36 @ 1½'	39	18
X-36 @ 2'	30	20
X-36 @ 4'	45	20
X-36 @ 8'	35	25
Z-22 @ 1'	49	22
Z-22 @ 3'	35	23



PROFILE DAM C
SCALE: 1" = 2' V, 1" = 10' H

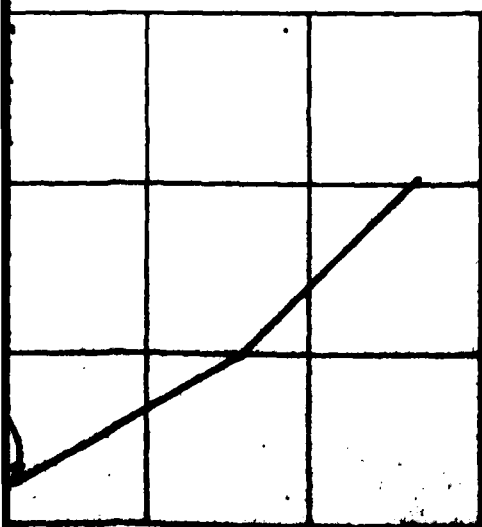


PROFILE SADDLE C (1)
SCALE: 1" = 2' V, 1" = 10' H

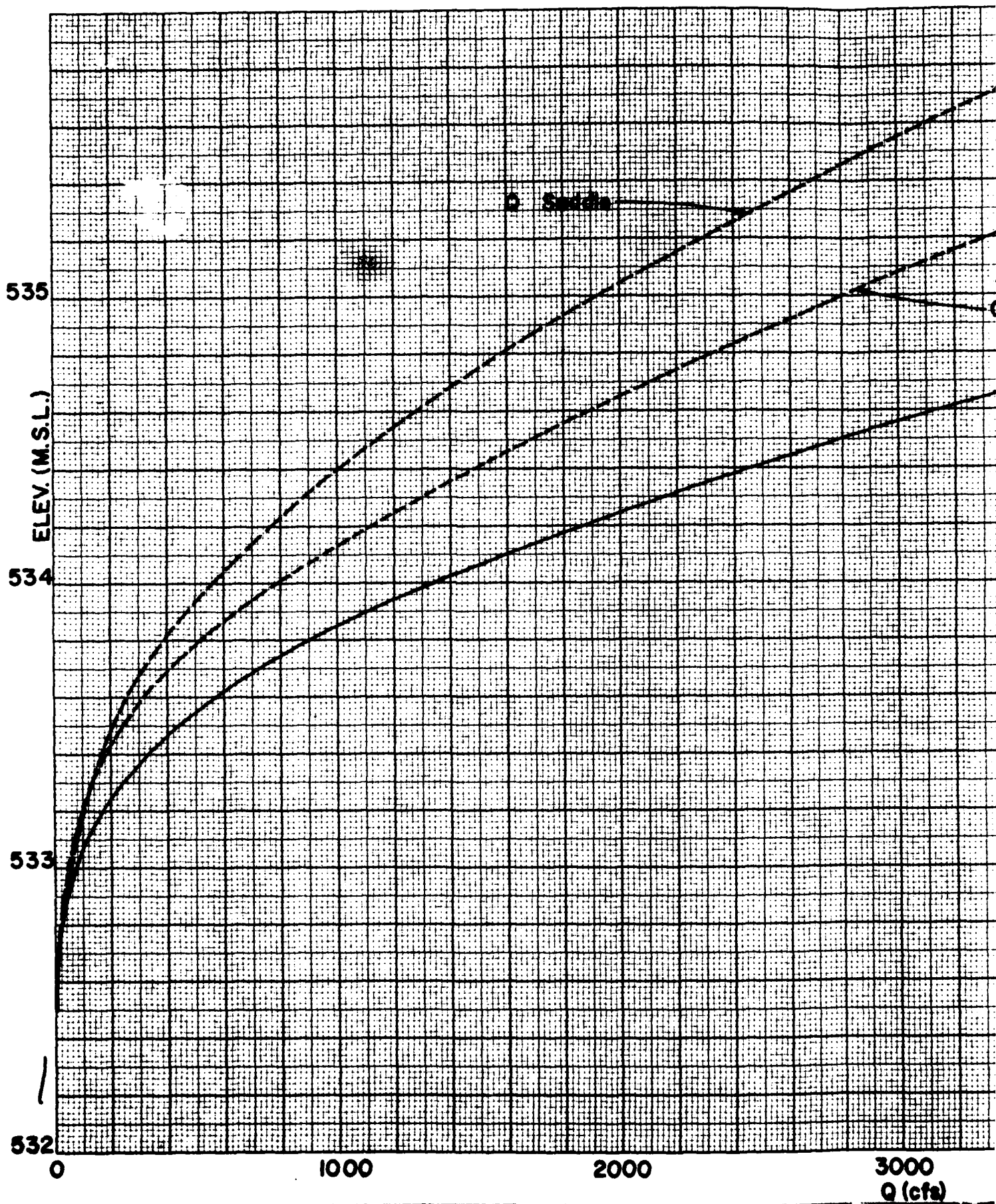


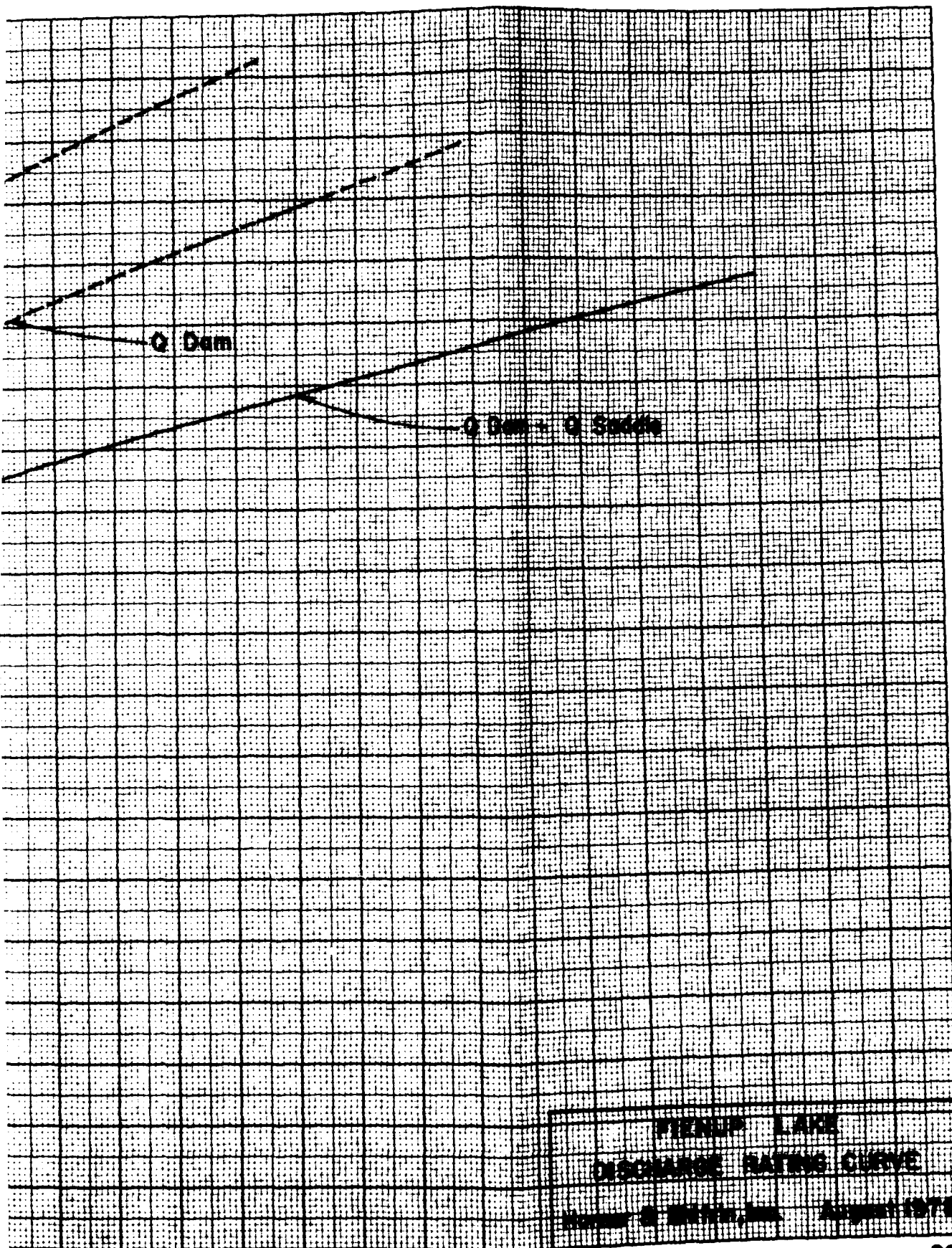
PROFILE DAM CREST
 SCALES: 1" = 2' V., 1" = 50' H.

(1) BASED ON TOPOGRAPHIC
 DATA SHOWN ON PLATE 2.



PIENUP LAKE
DAM & SADDLE PROFILES
 Horner & Smith, Inc. August 1970





PIEDMONT LAKE
DISCHARGE RATING CURVE

Revised 2/19/72 August 1972

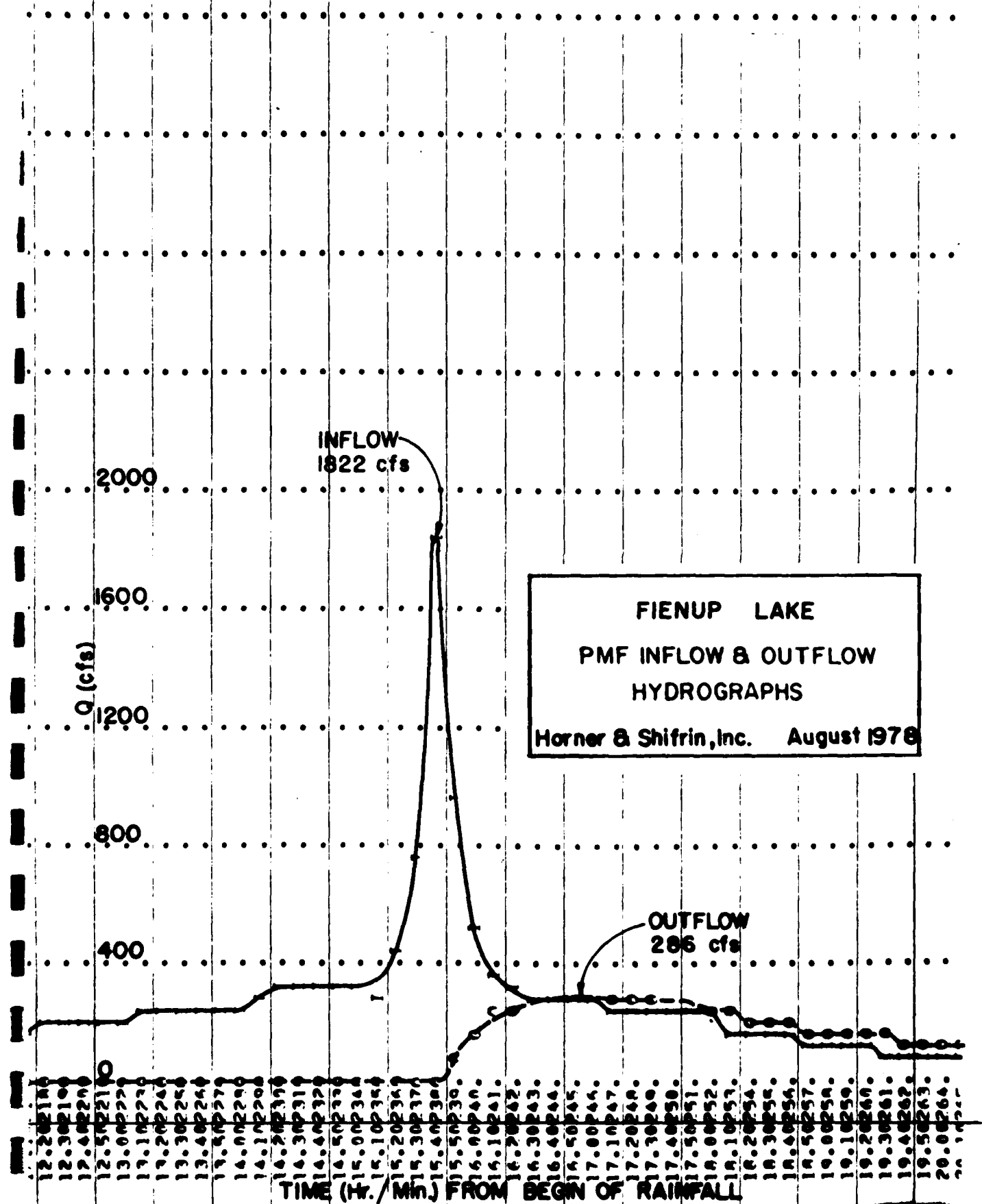
3000
Q (cfs)

24000

5000

6000

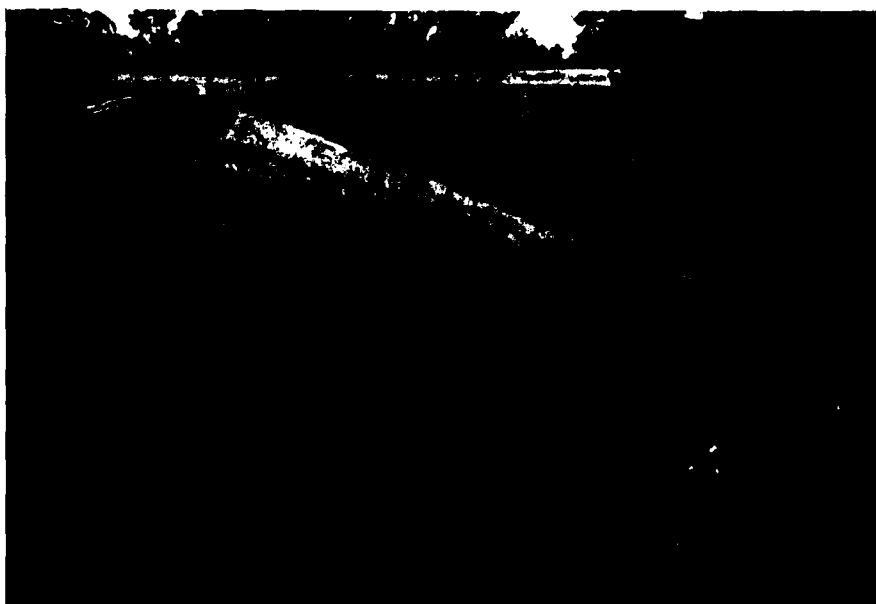
PLATE 13



APPENDIX



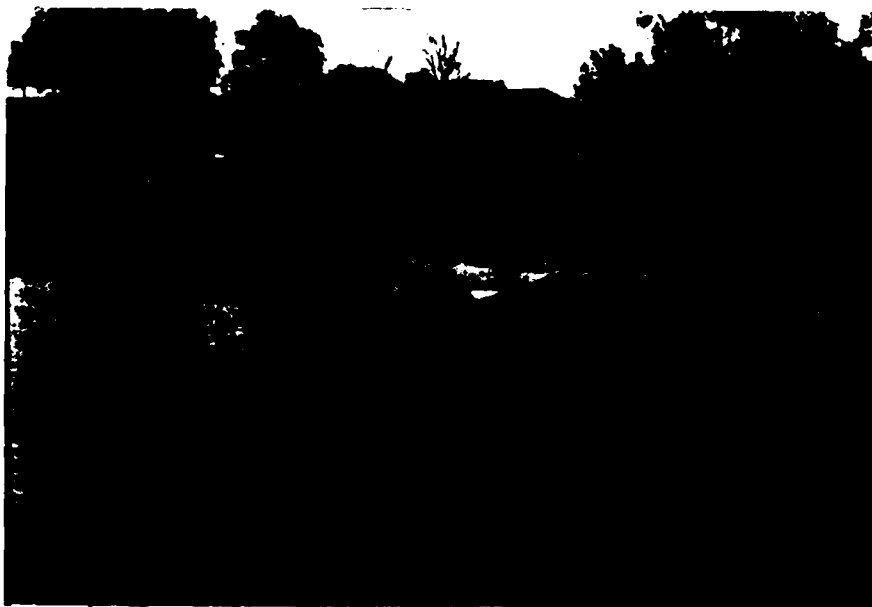
NO. 1: UPSTREAM FACE OF DAM



NO. 2: DOWNSTREAM FACE OF DAM



NO. 3: DAM AT WEST ABUTMENT



NO. 4: LAKE INFLOW PIPE

HYDROLOGIC COMPUTATIONS

1. The HEC-1 Dam Safety Version (July 1978) program was used to develop inflow and outflow hydrographs and dam overtopping analyses, with hydrologic inputs as follows:

a. Probable maximum precipitation (200 sq. mile, 24-hour value equals 25.0 inches adjusted to 48-hour value) from Hydrometeorological Report No. 33. One hundred year frequency (point source precipitation, 24-hour value equals 7.23 inches) from U.S. Weather Bureau Technical Paper No. 40.

b. Drainage area = 0.13 square miles
= 84 acres

c. SCS parameters
Lag time = 0.04 hours
Soil type CN = 80

2. The topographic saddle section consists of a broad-crested, approximately V-shaped earth section for which conventional weir formulas do not apply.

Saddle release rates were determined as follows:

- (1) Crest section properties (area, a and top width, T) were computed for various depths, d .
- (2) It was assumed that flow leaving the crest would occur at critical depth. Flow at critical depth (Q_c) was computed as $Q_c = \frac{(a^3 g)^{0.5}}{t}$ for the various depth, d .

Corresponding velocities (v_c) and velocity heads (H_{vc}) were determined using conventional formulas.

- (3) Static lake levels corresponding to the various Q_c values passing over the saddle were computed as critical depths plus critical velocity head ($d_c + H_{vc}$), and the relationship between lake level and discharge was thus obtained. The procedure neglects the minor insignificant friction losses across the length of the saddle.

3. The profile of the dam crest is irregular and flow over the dam crest cannot be determined by conventional weir formulas. Flow quantities overtopping the dam crest were computed as described in the preceding paragraph and corresponding flow over the dam and saddle for given elevations were added to obtain the combined outflow rating curve for the dam and saddle. This rating curve is shown on Plate 13. Inflow-outflow hydrographs for the PMF are presented on Plate 14.

 FLOOD HYDROGRAPH PACKAGE (MFC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 3 AUG 79

A1 ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
 A2 HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF FIENUP LAKE DAM
 A3 RATIOS OF PMF ROUTED THROUGH RESERVOIR

1	200	0	10	-0	-0	-0	-0	-0	-0
2	5								
3	1	3	1						
4	0.50	0.50	1.00						
5	0	INFLOW							
6	1	2	0.12						
7	0	25.0	102	120	130	140			
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

1	0.06								
2	-1.0	-0.10	2.0						
3	1	DAM							
4	1	RESERVOIR ROUTING BY MODIFIED PULS							
5	1								
6	1								
7	1								
8	1								
9	1								
10	1								
11	1								
12	1								
13	1								
14	1								
15	1								
16	1								
17	1								
18	1								
19	1								
20	1								
21	1								
22	1								
23	1								
24	1								
25	1								

1	532.5	532.7	533	533.2	533.4	533.7	534	534.5	535	535.5
2	0	10	70	150	330	720	1350	2820	4730	7020
3	0	27.0	34.6	39.5	46.7					
4	532.5	528	532	534	536					
5	532.5									
6	532.7									
7	00									
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

 FLOOD HYDROGRAPH PACKAGE (HFC-1)
 NEW SAFETY VERSION JULY 1978
 LAST MODIFICATION 3 AUG 78

ANALYSIS OF DAM OVERTOPPING USING 100 YR FLOOD									
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF FIENUP LAKE DAM									
100 YR FLOOD ROUTED THROUGH RESERVOIR									
	2RR	0	5	-0	-0	-0	-0	-0	-0
	1	1	1						
	1.0								
INFLW HYDROGRAPH									
	2	0.13							
	2RR								
01	.007	.007	.007	.007	.007	.007	.007	.007	.007
02	.007	.007	.007	.007	.007	.007	.007	.007	.007
03	.007	.007	.007	.007	.007	.007	.007	.007	.007
04	.007	.007	.007	.007	.007	.007	.007	.007	.007
05	.007	.007	.007	.007	.007	.007	.007	.007	.007
06	.007	.007	.007	.007	.007	.007	.007	.007	.007
07	.007	.007	.007	.007	.007	.007	.007	.007	.007
08	.007	.007	.007	.007	.007	.007	.007	.007	.007
09	.007	.007	.007	.007	.007	.007	.007	.007	.007
10	.007	.007	.007	.007	.007	.007	.007	.007	.007
11	.007	.007	.007	.007	.007	.007	.007	.007	.007
12	.007	.007	.007	.007	.007	.007	.007	.007	.007
13	.007	.007	.007	.007	.007	.007	.007	.007	.007
14	.007	.007	.007	.007	.007	.007	.007	.007	.007
15	.007	.007	.007	.007	.007	.007	.007	.007	.007
16	.007	.007	.007	.007	.007	.007	.007	.007	.007
17	.007	.007	.007	.007	.007	.007	.007	.007	.007
18	.007	.007	.007	.007	.007	.007	.007	.007	.007
19	.007	.007	.007	.007	.007	.007	.007	.007	.007
20	.007	.007	.007	.007	.007	.007	.007	.007	.007
21	.007	.007	.007	.007	.007	.007	.007	.007	.007
22	.007	.007	.007	.007	.007	.007	.007	.007	.007
23	.007	.007	.007	.007	.007	.007	.007	.007	.007
24	.007	.007	.007	.007	.007	.007	.007	.007	.007
25	.007	.007	.007	.007	.007	.007	.007	.007	.007
26	.007	.007	.007	.007	.007	.007	.007	.007	.007
27	.007	.007	.007	.007	.007	.007	.007	.007	.007
28	.007	.007	.007	.007	.007	.007	.007	.007	.007
29	.007	.007	.007	.007	.007	.007	.007	.007	.007
30	.007	.007	.007	.007	.007	.007	.007	.007	.007
31	.007	.007	.007	.007	.007	.007	.007	.007	.007
32	.007	.007	.007	.007	.007	.007	.007	.007	.007
33	.007	.007	.007	.007	.007	.007	.007	.007	.007
34	.007	.007	.007	.007	.007	.007	.007	.007	.007
35	.007	.007	.007	.007	.007	.007	.007	.007	.007
36	.007	.007	.007	.007	.007	.007	.007	.007	.007
37	.007	.007	.007	.007	.007	.007	.007	.007	.007
38	.007	.007	.007	.007	.007	.007	.007	.007	.007
39	.007	.007	.007	.007	.007	.007	.007	.007	.007
40	.007	.007	.007	.007	.007	.007	.007	.007	.007

39	01	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007
40	01	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007
41	T												0.32
42	42		0.04										
43	X	-1.0	-1.0	2.0									
44	K	1	NAV										
45	K1												
46	V												
47	V1	1											
48	V4	532.5	532.7	533	533.2	533.4	533.7	534	534.5	535	535.5	535	535.5
49	V5	0	10	70	150	330	720	1350	2820	4730	7020	4730	7020
50	SA	0	27.9	34.6	39.5	46.7							

51	9F489.35	528	532	534	536
52	98 532.5				
53	90 532.7				
54	K 90				

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